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SELECTION TESTS FOR ARMY OPERATORS OF HEAVY AND LIGHT MOTOR VEHICLES

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SELECTION TESTS FOR ARMY OPERATORS OF HEAVY AND LIGHT MOTOR VEHICLES

by

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PREFACE AND ACKNOWLEDGMENTS

The extent and scope of the present study necessitated close cooperation of a large number of organizations, both military and civilian. It would be impossible to name all who had a vital part in this study but the following personnel should be given credit for inauguration of the study, assistance in gathering data, and successful completion of the project.

Reflecting expressed need for such a study by the Transportation Corps, Dr. J.E. Uhlaner conceived the idea of the project. The undersigned contractors were assisted by Dr. Hubert Brogden, Mr. Edward Fuchs, and Dr. Arthur Drucker of Personnel Research Branch, The Adjutant General's Office, Department of the Army, in selecting tests and designing this study in the area of differential driver selection.

Col. A.W. Lyon, as Commanding Officer of the Transportation Research and Development Section at Ft. Eustis, made every effort to facilitate the study through his staff. Lt. Richard E. Wienke, as coordinating officer, was a most invaluable aid during the period of collection of data at Ft. Eustis.

Col. C.D. Foote, Commanding Officer, TRTC, at Ft. Eustis, and his staff gave every possible help to make the necessary men available for the tests and for completion of criterion data.

The writer is personally indebted to the Department of Army for the assignment of M/Sgt. Richard W. Hopper to this research for the period of collection of data, and particularly the assembly of the criterion elements upon which the success of the study depended. Most of the tests were given and scored by Mr. Harold I. Stalder and Mr. Lewis R. Vavra of the Driving Laboratory. Acknowledgment must also be made for the services of Mr. Abe Birnbaum from PRB, TAGO, for assistance during and in completing the required analyses.

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SELECTION TESTS FOR ARMY OPERATORS OF HEAVY AND LIGHT MOTOR VEHICLES

BRIEF

Specific selection tests of known efficiency are needed for the most economical assignment of recruits, replacements, and transfers to Military Occupational Specialties. In previous research, a group or battery of such selection tests was developed for assigning Army personnel to Army transportation units. This battery was designed to identify men who would be efficient drivers of Army motor vehicles, but no distinctions were made as to the type of vehicle to be operated. The Transportation Research and Development Station of the Transportation Corps at Ft. Eustis, Virginia made the suggestion that the aptitudes, skills, and other characteristics required for efficient operation of heavy Army vehicles may differ from those required for successful performance as a driver of light Army transport equipment. The objective of the study described in this report was to explore the possibility of developing batteries of selection tests which can not only select successful drivers, but also differentiate between men who will be successful drivers of heavy or of light Army motor vehicles.

A large number of tests was suggested for this purpose by previous research. As a preliminary trial to weed out inappropriate tests and to identify those warranting further study, the tests were given to 289 trainees in the Transportation Replacement Training Center School at Ft. Eustis, Virginia. Scores on these tests were compared with criterion measures of successful completion of driver training. The criterion was a composite of ratings of driver performance, grades in courses at the School, and scores on a road test.

The tests found to be the most promising in this preliminary trial were then given to groups of trainees driving wheeled Army motor vehicles of more than five tons capacity and to groups being trained to drive wheeled Army motor vehicles of less than five tons capacity. This study was limited to drivers of wheeled Army vehicles, because the majority of Army drivers are trained for this type of vehicle. (Further differentiation may be needed to select drivers of large combination vehicles.) Test scores were again compared with the criterion measure of successful driving to find out which tests were best able to predict efficient driving of the heavy or of the light Army motor vehicles.

On the basis of this information, various tests were combined, and the ability of these combinations or batteries to differentially predict training success was checked. The most efficient battery developed in this study for predicting success in learning to drive heavy wheeled vehicles included tests of knowledge of vehicles and driving practice, judgment of driving situations, personal characteristics, observation of detail, and muscular coordination. Alternate batteries were developed, should they be useful in the field. Attempts to develop batteries for predicting efficient performance as a driver of light Army motor vehicles were not an successful.

The batteries for predicting efficient driving of heavy motor vehicles are better selectors than the general battery previously developed which did not differentiate the type of vehicle to be operated.

SELECTION TESTS FOR ARMY OPERATORS OF HEAVY AND LIGHT MOTOR VEHICLES

CONTENTS

TABLES

SELECTION TESTS FOR ARMY OPERATORS OF HEAVY AND LIGHT MOTOR VEHICLES

I. INTRODUCTION

The suggestion has been made by the Transportation Research and Development Station that the aptitudes, skills, and other characteristics required for efficient operation of heavy Army vehicles may differ from those required for successful performance as a driver of light equipment. A previous study has shown (2) that paper-and-pencil group tests for selecting Army drivers, without regard to the type of vehicle operated, were five times as efficient in predicting successful driving performance as the selection tests then in use. It seemed feasible to explore the possibilities of further developing selection tests to the extent that they might be used to distinguish between successful drivers of heavy equipment and drivers of light Army motor vehicles. The objective of this study was to develop such differential selection tests.

The motorized equipment of the United States Army has tended to increase in size as well as in quantity. Four distinct types of equipment now in use, or being developed, may be classified as wheeled vehicles over five tons, wheeled vehicles under five tons, and two newer types of heavier combination vehicles which may also be categorized according to size. Since the drivers of the wheeled vehicles represent the larger percentage of Army drivers, it seemed advisable to limit the study to drivers of wheeled vehicles and as a first step to explore the possibilities of developing selection tests which distinguish successful drivers of the heavier and of the light wheeled vehicles. Further differentiation may be needed for selecting drivers of the larger combination vehicles. While it is recognized that some communality exists in the aptitudes and skills required for driving heavy and light Army motor vehicles as defined in this study, the results of the study were expected to indicate the aptitudes and skills, if any, in which the two classes of drivers differ.

II. DESIGN OF THE STUDY

The general plan of the study was first to select a large group of tests, inventories, and other predictors which, on logical grounds appeared to be feasible for predicting heavy Army motor vehicle and light Army motor vehicle driving success. In a preliminary run, these tests were given to Army driver trainees to weed out the least promising tests and to choose tests for more intensive research in the study proper. In the First or Experimental Run of the study proper, the chosen tests were then given to a group of trainees selected as best suited for driving heavy Army vehicles (referred to in this study as Group A) and to a group driving light Army motor vehicles (Group C). As a further check on the predictors (cross-validation), the tests were given in the Second Run to other groups of heavy and of light vehicle drivers (Groups B and D). On the basis of the information from these two runs (Experimental and Cross-Validation

Runs), batteries of tests were selected for differentially predicting success in learning to drive heavy and light vehicles.

A. TEST AND PREDICTOR VARIABLES

The test and predictor variables tried out in this study may be categorized into four groups as follows:

1. Data from Army personnel records.
2. Physical measurements available from records or made in this study.
3. Tests, of a psychophysical nature, given individually.
4. Driving aptitude tests of the paper-and-pencil type.

The tests are described in Appendix A and B. For convenience the test variables are summarized as follows:

a. Personnel Records Data. The following information was taken from the soldier's records:

Score on Mechanical Aptitude Test
Reading Vocabulary score
Automotive Information Test score
Shop Mechanics score
Previous experience with private and commercial vehicles
Highest grade completed in school

b. Physical Measurements.

Weight
Height
Waist measure
Chest measure
Reach

c. Psychophysical Measurements.

Reaction time
Hand, arm, and chest strength
Muscular coordination
Motility or activity index (speed of movement)
Steadiness
Field of vision
Distance judgment (Howard-Dohlman Test)
Visual acuity (Snellen Chart)

d. Paper-and-pencil Tests.

Vehicle Preference, CRT 266
Vehicle Knowledge, CRT 260--a new type of knowledge test using pictures

d. Paper-and-pencil Tests (continued)

Heavy Vehicle Know-How, CRT 262--a test designed to sample a driver's knowledge of heavy vehicles

Several tests found to be successful for predicting Army driving performance in a previous study (2):

1) Those pertaining to knowledge of driving, such as Driver Know-How, DA PRT 2412.

2) Those assumed to sample perceptual factors, such as Attention to Detail, DA PRT 2374, Difference Detection, CRT 216, Object Identification, CRT 65, and Lateral Perception, CRT 66.

3) Those assumed to sample judgment of accident situations, such as Emergency Judgment, CRT 196.

4) Those pertaining to motor control and coordination, including Two-Hand Coordination, DA PRT 2387, Tracing Coordination, CRT 60, and Army Path Tracing, DA PRT 2382.

5) Those related to activity, such as the Motility Test, CRT 62.

6) Those relating to experience, attitudes, and personality factors, such as the Drivers' Self Description Inventory, DA PRT 2457 and Accuracy, CRT 218.

7) Those related to visual efficiency and seeing, including Visual Acuity, CRT 202 and Word Matching, CRT 207.

B. THE CRITERION

Scores on the tests in this study were compared with a criterion measure (coded as T in the tables of this Report) of success in the driver training program. The criterion was a composite of standard scores on the three elements described below. Each of the elements was equally weighted in computing the composite.

1. The average of four ratings on the Army Driver Ratings Form, DA PRT 2408 (using scales 2, 3, 4, and 5 of this Rating Form) made by instructors of driving in the Transportation Replacement Training Center (TRTC) School at Ft. Eustis, Virginia. The Rating Form was developed in previous research (1) to serve as a criterion measure in various driver research programs.

2. The average of at least three grades on course work in the TRTC School.

3. Scores on the Road Test, DA FRT 561 given by Army driving instructors at the completion of the courses in heavy and light Army motor vehicle driving at the same school.

Further details on the criterion are given in Appendix C.

C. CHOICE OF TESTS AND BATTERIES.

The following considerations were used in choosing a test to be tried out on the various runs of this study and in selecting a test for inclusion in the various batteries developed:

1. Reliability of the scores on the test.

2. Efficiency of the test as a differential predictor of heavy and of light Army motor vehicle driving success.

3. Independence (or uniqueness) of the test from other tests in a group.

4. Availability in the current Army classification procedures at reception centers.

5. Length of time required to give the test.

6. Simplicity and ease of giving the test.

D. DRIVER SAMPLES

On the recommendation of Personnel Research Branch, The Adjutant General's Office and the Transportation Corps, the trainees in the TRTC School at Ft. Eustis, Virginia were used as examinees in this study. Any man sent to this school was likely to be used in this study. After recruits complete basic training, those showing evidence of driving aptitude are sent to the TRTC School from several eastern and southeastern states for ten weeks of training. Enrollees coming into the school were divided into two groups: those considered best fitted for heavy Army vehicle driving, and those thought to be best suited to driving wheeled Army vehicles under five tons. Each class was divided as equally as possible into heavy and light vehicle trainees. Specially devised courses were given to each group.

In the Preliminary Run, trainees were tested from 20 November to 30 December 1952; in the First Run and Second Run of the study proper, from 6 April to 15 June 1953. In the Preliminary Run, 314 drivers were tested. The results of 289 of these were complete and were used in the analysis. In the First and Second Runs, 805 drivers were given the tests, and 780 records were complete. In the First Run, the results for 198 drivers of

heavy vehicles (Group A) and for 196 drivers of light vehicles (Croup C) were used in the analyses. In the Second Run, the results for 192 drivers of heavy vehicles (Group B) and for 194 drivers of light vehicles (Croup D) were used. In summary:

First Run--Experimental Groups

Heavy	198	A
Light	196	C

Second Run--Cross-Validation Groups

Heavy	192	B
Light	194	D

All the men were examined in convenient groups of 25-40 at a time. Depending upon the type of training they were being given (for heavy or for light vehicles), they were selected for Groups A and B or Groups C and D. Assignment to the Experimental Groups (A and C) or to the Cross-Validation Groups (B and D) was done so as to control or avoid the undue influences upon the results of characteristics irrelevant to this study. The only departure from the type of selection ("random") was an attempt to keep the proportions of White and Negro examinees the same in each of the Experimental and of the Cross-Validation groups.

E. PROCEDURE

The details of the procedure for giving the tests and gathering the criterion data in this study are presented in Appendix D. All the men in a given run were administered all the tests chosen for that run; the criterion elements (ratings and grades) measured for each group of men were those appropriate to the training the men were being given. Scores on the tests were intercorrelated with each other and with the composite of the criterion elements. This information (along with the other considerations listed in Section C above) was used in combining tests into batteries and in determining the predictive efficiency of the selected batteries.

III. TEST RESULTS

A. PRELIMINARY RUN

Test scores and criterion data on the 289 trainees in the Preliminary Run were collected in twelve-hour testing periods spread over three half days. Test scores were correlated with the composite criterion. The validity coefficients of the more promising of the tests in the Preliminary Run are shown in Table 1.

Table 1. Correlations of Selected Predictors with the Criterion in the Preliminary Run. N = 289.

Variable or Predictor	Army Desig.	Validity Coefficient
Vehicle Preference	CRT 266	.07
Vehicle Knowledge	CRT 260	.22
Driver Know-How	PRT 2412	.40
Heavy Vehicle Know-How	CRT 262	.29
Attention to Detail	PRT 2374	.22
Two-Hand Coordination	PRT 2387	.08
Emergency Judgment	CRT 87	.24
Word Matching	CRT 207	.06
Visual Acuity (II, III and IV)	CRT 202	.22
Object Identification	CRT 222	.24
Lateral Perception	CRT 209	.24
Difference Detection	CRT 216	.16
Accuracy	CRT 218	.06
Mobility	CRT 215	.16
Driver S.D. Blank (Revised)- Part III	CRT 257	.31
Total		.31
Coordination (Individual)	CRT 263	.32
Reaction Time (False start)(Individual)	CRT 263	-.01
Significance levels - 1 per cent		.113
5 per cent		.148

The tests having a reasonable validity for predicting driving ability and which appeared to be more or less independent of each other were selected for the First and Second Runs of the study.

B. FIRST AND SECOND RUNS

Since the purpose of the Experimental and the Cross-Validation Runs was to identify the promising tests of a first run which hold up when evaluated on a second but similar population, the results of the First Run and of the Second Run will be presented together.

The First and Second Run results for the drivers of heavy vehicles (Groups A and B) are presented in Table 2. The table presents the correlations of scores on the predictor test with the criterion elements and the composite criterion for Group A (First Run) and the cross-validity coefficients for Group B (Second Run).

Table 2. Correlations of Predictors with the Criterion. Heavy Drivers. Group A (Experimental) and Group B (Cross-Validation).

	Variable	Group A N = 198 Rating Q	Grades R	Road Test S	Composite T	Group B N = 192 Composite T
1	Vehicle Knowledge	.16	.45	.19	.37	---
2	Age	.12	-.07	.04	.04	---
3	H-V Driver Know-How	.16	.59	.27	.47	.37
4	Height	.03	-.07	.08	.01	---
5	Driver Know-How	.13	.53	.21	.40	.38
6	Weight	.08	.07	.05	.09	---
7	Attention to Detail	-.10	.22	.11	.10	---
8	Reach	.03	-.09	.01	-.02	---
9	Emergency Judgment	.17	.50	.15	.38	.33
A	Chest	.15	.13	.02	.16	-.02
B	Object Identification	.06	.48	.16	.33	.31
C	Lateral Perception	.10	.46	.18	.34	.31
D	Word Matching	.05	.47	.15	.32	.34
E	Strength - Hand	.13	.07	.05	.11	---
F	Visual Acuity	.11	.38	.18	.31	.37
G	Strength - Arm	-.06	.06	.04	.01	---
H	Two-Hand Coordination	.10	.16	.10	.17	.23
I	S.D. Blank, Part I	-.04	.07	.25	.11	---
J	Strength - Shoulder	-.08	.07	.03	.01	---
K	S.D. Blank, Part II	.18	.30	.15	.30	.10
L	S.D. Blank, Part III	.03	.31	.17	.23	.19
M	S.D. Blank, Total	.05	.35	.26	.30	.26
N	Difference Detection	.17	.37	.15	.32	.33
O	Coordinometer	.07	.16	-.01	.11	.19
P	Grade in School	.01	.23	.16	.18	---
U	Aptitude Area I	.10	.48	.12	.33	---
V	Mechanical Aptitude	.09	.35	.10	.26	.27
W	Shop Mechanics	.19	.44	.15	.37	.25
X	Auto Information	.19	.46	.27	.43	.37

Level of Confidence: 1 per cent = .181
5 per cent = .138

The intercorrelations of the most useful predictors for the groups of heavy vehicle drivers are presented in Tables 3 and 4. "Most useful test" was here defined as a test of which the validity coefficients were sufficiently high in one or both of the experimental and cross-validation groups, any of which the inter-correlations were sufficiently low to indicate reasonable independence of other tests in the group. In other words, a test capable of making a reasonably unique contribution to a battery of tests.

Table 3. Intercorrelations of Predictors. Heavy Drivers. Group A (Experimental). N = 198

	Variable	Variables Intercorrelated																
		3	5	9	A	B	C	D	F	H	K	L	M	N	O	V	W	X
3	M-W Know-How CRT 262	—																
5	Driver Know-How PRT 2412	.72	—															
9	Emergency Judgment CRT 87	.68	.63	—														
A	Chest CRT 263	.16	.13	.10	—													
B	Object Identification CRT 222	.64	.58	.68	.23	—												
C	Lateral Perception CRT 200	.46	.45	.57	.14	.67	—											
D	Word Matching CRT 207	.53	.53	.63	.08	.63	.59	—										
F	Visual Acuity (II,III & IV) CRT 202	.41	.42	.53	.18	.52	.62	.49	—									
H	Two-Hand Coordination PRT 2387	.16	.10	.25	.02	.20	.27	.14	.24	—								
K	S.D. Blank, Part II CRT 257	.21	.18	.13	.11	.22	.15	.18	.07	.10	—							
L	S.D. Blank, Part III CRT 257	.45	.45	.42	.10	.41	.31	.39	.37	.05	.24	—						
M	S.D. Blank, Total CRT 257	.46	.46	.40	.11	.40	.32	.40	.36	.09	.49	.90	—					
N	Difference Detection CRT 216	.50	.45	.59	.08	.63	.59	.56	.58	.24	.16	.41	.39	—				
O	Coordinometer CRT 263	.13	.13	.13	.10	.08	.12	.10	.14	.08	.09	.03	.09	.13	—			
V	Mechanical Aptitude APR	.49	.46	.53	.16	.53	.45	.45	.47	.12	.10	.28	.28	.57	.08	—		
W	Shop Mechanics APR	.61	.55	.63	.21	.59	.55	.50	.47	.20	.08	.35	.31	.54	.15	.68	—	
X	Auto. Information APR	.64	.59	.62	.12	.58	.49	.47	.41	.13	.17	.38	.41	.59	.14	.68	.71	—

(See Table 2 for Complete Legend)

Level of Confidence: 1 per cent = .181
5 per cent = .138

Table 4. Intercorrelations of Predictors. Heavy Drivers. Group B (Cross-Validation). N = 192

	Variable	Variables Intercorrelated																
		3	5	9	A	B	C	D	F	H	K	L	M	N	O	V	W	X
3	M-V Know-How CRT 262	---																
5	Driver Know-How PRT 2412	.75	---															
9	Emergency Judgment CRT 87	.64	.62	---														
A	Chest CRT 263	-.11	-.07	-.05	---													
B	Object Identification CRT 222	.56	.50	.69	-.02	---												
C	Lateral Perception CRT 200	.43	.39	.60	-.02	.69	---											
D	Word Matching CRT 207	.54	.50	.56	.05	.64	.68	---										
F	Visual Acuity (II, III & IV) CRT 202	.45	.44	.58	-.03	.65	.64	.60	---									
H	Two-Hand Coordination PRT 2387	.16	.14	.26	.01	.33	.39	.34	.27	---								
K	S.D. Blank, Part II CRT 257	.20	.20	.16	.07	.16	.12	.18	.11	.04	---							
L	S.D. Blank, Part III CRT 257	.43	.47	.47	-.06	.36	.32	.36	.28	.04	.35	---						
M	S.D. Blank, Total CRT 257	.47	.52	.47	.02	.36	.30	.36	.31	.03	.57	.91	---					
N	Difference Detection CRT 216	.52	.52	.63	.04	.68	.56	.65	.62	.32	.27	.41	.46	---				
O	Coordinometer CRT 263	.24	.31	.19	.02	.22	.24	.21	.27	.07	-.10	.15	.15	.23	---			
V	Mechanical Aptitude APR	.63	.44	.62	-.02	.63	.52	.49	.54	.25	.15	.32	.33	.56	.17	---		
W	Shop Mechanics APR	.64	.54	.67	-.05	.62	.49	.52	.53	.23	.28	.46	.50	.61	.06	.69	---	
X	Auto. Information APR	.66	.60	.61	-.05	.55	.49	.53	.45	.14	.23	.37	.44	.55	.22	.70	.73	---

(See Table 2 for Complete Legend)

Level of Confidence: 1 per cent = .181
5 per cent = .138

Similar results for the drivers of light vehicles are presented in Tables 5, 6 and 7.

Table 5. Correlations of Predictors with the Criterion. Light Drivers. Group C (Experimental) and Group D (Cross-Validation)

		Group A N = 198				Group D N = 194
	Variable	Rating Q	Grades R	Road Test S	Composite T	Composite T
1	Vehicle Knowledge	.04	.28	.06	.20	---
2	Age	.14	.01	.02	.08	---
3	H-V Driver Know-How	.01	.37	.04	.22	.42
4	Height	.01	-.03	.01	-.01	---
5	Driver Know-How	.02	.42	.03	.25	.41
6	Weight	.15	-.11	.10	.06	---
7	Attention to Detail	.01	.18	.10	.13	.20
8	Reach	.03	-.10	-.02	-.05	---
9	Emergency Judgment	-.05	.34	.06	.17	.29
A	Cheat	.14	.09	-.03	.11	---
B	Object Identification	-.10	.33	-.03	.12	.25
C	Lateral Perception	-.02	.32	-.01	.16	.15
D	Word Matching	-.08	.37	-.03	.15	.22
E	Strength - Hand	.21	.09	.06	.19	.21
F	Visual Acuity	.02	.33	.00	.19	.23
G	Strength - Arm	-.02	.12	.05	.06	---
H	Two-Hand Coordination	.12	.18	.08	.18	.09
I	S.D. Blank, Part I	.32	.22	.25	.37	.13
J	Strength - Shoulder	.13	-.07	.12	.07	---
K	S.D. Blank, Part II	.03	.12	.01	.09	---
L	S.D. Blank, Part III	-.11	.18	.03	.04	---
M	S.D. Blank, Total	.01	.25	.12	.18	.41
N	Difference Detection	-.07	.26	.00	.11	.29
O	Coordinometer	.24	.24	.10	.29	.15
P	Grade in School	-.13	.09	-.09	-.05	---
U	Aptitude Area I	-.08	.32	-.12	.10	---
V	Mechanical Aptitude	.03	.24	-.03	.15	.26
W	Shop Mechanics	-.04	.34	-.02	.16	.30
X	Auto. Information	.06	.37	.11	.26	.25

Level of Confidence: 1 per cent = .181
5 per cent = .138

Table 6. Intercorrelations of Predictors. Light Drivers. Group C (Experimental). N = 196

	Variable	Variables Intercorrelated																		
		3	5	7	9	A	B	C	D	E	F	H	I	K	L	M	N	O	V	W
3	H-V Know-How CRT 262	—																		
5	Driver Know-How PRT 2412	.75	—																	
7	Attention to Detail PRT 2374	.27	.31	—																
9	Emergency Judgment CRT 87	.60	.69	.44	—															
A	Chest CRT 263	.09	.09	-.03	-.06	—														
B	Object Identification CRT 222	.58	.59	.55	.74	-.04	—													
C	Lateral Perception CRT 200	.40	.48	.52	.59	-.03	.71	—												
D	Word Matching CRT 207	.46	.50	.37	.61	-.04	.64	.59	—											
E	Strength - Hand CRT 263	.01	.00	.06	-.16	.36	-.17	-.12	-.16	—										
F	Visual Acuity (II,III & IV) CRT 202	.39	.41	.44	.54	.04	.64	.65	.54	-.05	—									
H	Two-Hand Coordination PRT 2387	.09	.12	.33	.13	.10	.26	.37	.16	-.01	.32	—								
I	S.D. Blank, Part I CRT 257	.04	.19	.06	.07	.17	-.08	.07	.00	.23	.15	.06	—							
K	S.D. Blank, Part II CRT 257	.27	.27	.11	.16	.04	.27	.19	.25	-.09	.11	.13	-.05	—						
L	S.D. Blank, Part III CRT 257	.50	.49	.28	.53	.02	.44	.40	.44	-.09	.31	.05	-.01	.25	—					
M	S.D. Blank, Total CRT 257	.50	.55	.29	.51	.08	.41	.41	.44	-.03	.34	.09	.29	.44	.92	—				
N	Difference Detection CRT 216	.48	.56	.45	.69	-.06	.71	.68	.56	-.12	.60	.17	.03	.25	.52	.52	—			
O	Coordinometer CRT 263	.07	.11	.06	-.03	.02	-.07	.10	.04	.21	.09	.15	.27	.08	.01	.12	-.05	—		
V	Mechanical Aptitude APR	.50	.57	.45	.65	-.08	.67	.58	.48	-.12	.52	.14	.04	.31	.37	.41	.61	.05	—	
W	Shop Mechanics APR	.59	.60	.33	.67	-.02	.65	.56	.50	-.11	.52	.13	.07	.28	.40	.43	.60	.05	.77	—
X	Auto. Information APR	.59	.65	.38	.65	.08	.57	.43	.38	-.02	.42	.05	.14	.24	.39	.43	.53	.05	.69	.80

(See Table 5 for Complete Legend)

Level of Confidence: 1 per cent = .181
5 per cent = .138

Table 7. Intercorrelations of Predictors. Light Drivers. Group D (Cross-Validation). N = 194

	Variable	Variables Intercorrelated																
		3	5	7	9	B	C	D	E	F	H	I	M	N	O	V	W	X
3	H-V Know-How CRT 262	—																
5	Driver Know-How PRT 2412	.66	—															
7	Attention to Detail PRT 2374	.34	.33	—														
9	Emergency Judgment CRT 87	.54	.49	.52	—													
B	Object Identification CRT 222	.56	.46	.63	.73	—												
C	Lateral Perception CRT 200	.40	.33	.65	.66	.75	—											
D	Word Matching CRT 207	.44	.36	.49	.59	.62	.58	—										
E	Strength - Hand CRT 263	.21	.23	.07	.06	.04	-.05	.06	—									
F	Visual Acuity (II,III & IV) CRT 202	.42	.35	.62	.65	.74	.70	.60	.08	—								
H	Two-Hand Coordination PRT 2387	.13	.20	.37	.23	.28	.27	.29	.16	.25	—							
I	S.D. Blank, Part I CRT 257	.15	.23	.02	.10	-.02	-.01	.11	.19	.02	-.11	—						
M	S.D. Blank, Total CRT 257	.48	.57	.24	.49	.42	.30	.43	.11	.35	.11	.46	—					
N	Difference Detection CRT 216	.46	.44	.63	.62	.70	.64	.58	.03	.66	.25	.08	.42	—				
O	Coordinometer CRT 263	.12	.10	.22	.07	.11	.08	.13	.16	.12	.11	.08	-.01	.12	—			
V	Mechanical Aptitude APR	.53	.43	.54	.64	.73	.60	.53	.02	.56	.25	.04	.34	.61	.12	—		
W	Shop Mechanics APR	.60	.50	.44	.66	.68	.57	.45	.07	.60	.22	.07	.41	.59	.13	.72	—	
X	Auto. Information APR	.61	.51	.33	.56	.48	.36	.37	.13	.43	.10	.33	.44	.46	.13	.61	.71	—

(See Table 5 for Complete Legend)

Level of Confidence: 1 per cent = .181
5 per cent = .138

IV. SELECTION OF DRIVER BATTERIES

The basic statistical data used in developing differential batteries for predicting success in learning to drive heavy and light vehicles are presented in Appendix E. The most promising tests, according to the considerations listed previously, were tried out in various combinations. The combinations or batteries having the highest predictive efficiency are considered here.

A. BATTERIES FOR HEAVY DRIVERS

The most efficient battery developed in this study for predicting ability to drive heavy vehicles is listed in Table 8 along with the statistical information used to determine the contribution of each test to the efficiency of the battery. The individual tests are listed in order of their contribution to the battery. The cross-validity coefficient of Battery I was .45. The working time of this battery is about 60 minutes.

Table 8. Most Efficient Predictors for Heavy Driving Ability--Battery I.

Predictor	Army Desig.	Beta's from A	r's from B
H-V Driver Know-How	CRT 262	.2835	.3665
Automotive Information	ACT	.1815	.3691
Visual Acuity (II, III and IV)	CRT 202	.0776	.3707
Two-Hand Coordination	HRT 2387	.0784	.2263
S.D. Blank, Total	CRT 257	.0564	.2635

The addition of other variables did not materially increase the predictive efficiency of Battery I. However, if an alternate battery is desired, the tests in Table 9 are suggested. The cross-validity coefficient of Battery II was .41. Working time of this battery is 40 minutes.

Table 9. Alternate Battery of Predictors for Heavy Driving Ability--Battery II.

Predictor	Army Desig.	Beta's from A	r's from B
H-V Driver Know-How	CRT 262	.3780	.3665
Lateral Perception	CRT 200	.1445	.3076
Difference Detection	CRT 216	.0397	.3311
Coordinometer	CRT 263	.0211	.1924

These differential batteries are about 1½ times more efficient than the general batteries developed by a previous study (2) for predicting driving success without regard to type of vehicle.

B. BATTERIES FOR LIGHT DRIVERS

The same type of analysis made of Group A and B data was also made of the Group C and D data in order to select predictors of light driving ability. The most efficient differential battery is listed in Table 10.

Table 10. Most Efficient Battery for Light Driving Ability--Battery III.

Predictor	Army Desig.	Beta's from C	r's from D
Driver Know-How	FRT 2412	.1181	.4099
S.D. Blank, Part I	CRT 257	.2643	.1342
Coordinometer	CRT 263	.1896	.1509
Hand Strength	CRT 263	.1042	.2107
Emergency Judgment	CRT 87	.0897	.2875

The cross-validity coefficient of Battery III was .35. Working time of this battery is 50 minutes.

A group of tests that could be used as an alternate battery for predicting ability to drive light Army motor vehicles is listed in Table 11.

Table 11. Alternate Battery of Predictors for Light Driving Ability--Battery IV.

Predictor	Army Desig.	Beta's from C	r's from D
Driving Know-How	FRT 2412	.1648	.4099
S.D. Blank, Part I	CRT 257	.2333	.1342
Shop Mechanics	ACT	.0375	.3018
Emergency Judgment	CRT 87	.0303	.2875
Difference Detection	CRT 216	-.0375	.2852

The cross-validity coefficient of Battery IV was .29. Working time is about 50 minutes.

These differential batteries for light drivers are only slightly more efficient than the general battery developed by the previous study (2) in which heavy and light drivers were grouped together.

C. CROSS-COMPARISON OF THE DIFFERENTIAL BATTERIES

As a check on the differential characteristics of the batteries developed by this study, the best heavy battery (I) was tried out on drivers of light Army motor vehicles, and the best light battery (III) was tried out on drivers of heavy Army motor vehicles. The results of this cross-comparison are presented in Table 12.

Table 12. Comparison of Results of Heavy Battery I Applied to Light Drivers and Light Battery III Applied to Heavy Drivers

Combination	Validities on Light Drivers R	Validities on Light Drivers Cross-Validity r	Validities on Heavy Drivers R	Validities on Heavy Drivers Cross-Validity r
Heavy - Battery I	.32(C) .49(D)	.34(D) .22(C)	.52(A) .47(B)	.45(B) .48(A)
Light - Battery III	.47(C) .45(D)	.35(D) .35(C)	.44(A) .41(B)*	.40(B)* .43(A)*

*These values are based on three tests of Battery III.

If the batteries are capable of distinguishing heavy and light drivers, then the validity coefficients of the cross-comparison should be less than the validity coefficients obtained when the batteries were applied to the intended type of driver (the coefficients in the negative quadrants of Table 12 should be less than the coefficients in the corresponding columns). The data in Table 12 indicate that the batteries are capable of some differential prediction.

V. CONCLUSIONS

In summary, the results given in Table 13 were found in this study.

Table 13. Comparison of Validity Coefficients of Selected Batteries.

Types of Drivers	Battery	Multiple R		Cross Validity** r
		Population A - Population B		
Heavy I	R_T. 3,X,H,M,F*	.52	.47	.45
Heavy II	R_T. 3,C,N,O	.49	.42	.41
		Population C - Population D		
Light III	R_T. 5,9,E,I,O	.47	.45	.35
Light IV	R_T. 5,9,I,N,W	.41	.43	.29

*Code same as Table 2 and 5

**The cross-validity coefficients were calculated by a formula recommended by Personnel Research Branch, TAGO.

From the analyses of the data in this study, the following conclusions seem warranted:

1. Batteries I and II may be used for differential selection of drivers of heavy Army motor vehicles, and Batteries III and IV may be considered for differential selection of drivers of light Army motor vehicles.

2. The hypothesis that differential prediction batteries are feasible was sustained only in part. Batteries I and II (for heavy wheeled vehicles) were consistently more efficient than the batteries for predicting ability to drive light Army wheeled vehicles.

3. The differential batteries developed in this study were more efficient predictors of success in learning to drive heavy Army motor vehicles than the general battery developed in a previous study for predicting driving ability without regard to the type of vehicle driven.

4. The best predictors of heavy driving ability were found to be: knowledge of vehicles and driving, judgment of driving situations, information from self-description blanks, observation of detail, and muscular coordination.

5. Measures of similar factors, but in different combinations, with the addition of two psychophysical tests (hand strength and coordination) were found to be the best predictors of success in learning to drive light wheeled vehicles.

6. Body size, arm and chest strength, age, and educational experience seemed to be relatively ineffective in predicting either heavy or light Army vehicle driving ability.

REFERENCES

Reports of the Personnel Research Branch, Personnel Research and Procedures Division, The Adjutant General's Office, Department of the Army.

1. PRB Report 935. The development of criteria of safe driving for the individual. April 1952.

2. PRB Report 981. Aptitude tests for Army motor vehicle operators. (Contract CSA 191, Iowa State College) October 1952.

VI. APPENDIXES

APPENDIX A - DESCRIPTION OF TESTS USED

Only those tests and predictors new to this study are described here. All others previously used were described in the earlier study (2) of Army driving aptitude.

From the inferences derived from the exploratory analysis completed in the study of Army driving aptitude (ibid) a series of instruments were developed for specific evaluation as differential predictors:

1. CRT 260 - Vehicle Knowledge. A pictorial type of test using Army equipment and based on Army motor vehicle manuals. The items covered certain aspects of size, usage, or function of the vehicles and equipment shown. It is adapted for IBM scoring and was put up in lithoprint form. There are 48 items in the test and the working time 20 minutes. (See Plate I-3).

2. CRT 261 - Drivers Psycho-Sociological Inventory. A special type of short questionnaire formerly used at Iowa State College in evaluating commercial drivers. It was designed to uncover factors of the driver's experience hypothesized to relate to accidents and inefficient driving. (Sample not shown.) The working time was 12 minutes for 35 items.

3. CRT 262 - Heavy Vehicle Know-How indicated as H-V Know-How. Originally a 96 item information test based on the training manuals used in the TRTC School. The working time was 35 minutes. After the preliminary run, it was item analyzed and reduced to 20 minutes working time by using only 65 items. (See Plate I-2).

4. CRT 263 - Psychophysical Tests and Auxiliary Data. The only ones of this group of tests described here and shown in Plate II are:

   a. The Coordinometer. A specially designed lever-type control coordination device involving eye hand-body coordination. The task is to maneuver a 3/4 inch ball bearing through a maze in such a way as to avoid traps or holes in the runway. It involves coordination, perceptual accuracy, and close attention for successful performance. (See Plate II-3 for general features of the apparatus.) It is an individual test and five or ten trials are used which average about one minute each.

   b. Arm Strength. A special torsion dynamometer in which the grip and forearm muscles play an important role. The measurements are recorded in pounds from a standard calibrated bath-room scale. 4 trials were used as the score or index. (See Plate II-1 for general plan.)

   c. Shoulder Strength. A tension dynamometer held at a distance of arms length from the subject's chest. It was designed to measure the strength of arms and shoulders at arms length. 4 trials were used as the score. (See Plate II-2)

5. CRT 264 - Driver's Background Experience Index. Graduated checklists of hobbies and types of activities at different age levels were hypothesized to indicate possible differentiating characteristics of light and heavy drivers. Working time 15 minutes and the inventory contained 100 items. (Not shown in Plate I.)

6. CRT 265 - Driver Performance Inventory L-S. An adaptation and combination of PRT 2408 and the Roger's Scale. It was designed by Lauer and Suhr for use with commercial drivers and contains 45 items. The inventory may be used or marked by anyone familiar with the driver's habits while at the wheel. The scores are reflected. Earlier studies with the Roger's Scale have shown it to have high reliability and fair validity for checking drivers enroute. The time required for checking the complete inventory as used here may vary from 10 to 15 minutes. The ratings derived are in positive form, that is, the highest ratings are assumed to be most desirable. (See Plate I-7)

7. CRT 266 - Motor Vehicle Preference Inventory. A 48 item pictorial test designed to indicate the examinees preference for driving light or heavy Army vehicles. It was postulated that persons showing preference for a certain type of vehicle might show better performance through motivation or superior knowledge of such type vehicles. The working time is 20 minutes. (See Plate I-1).

8. CRT 267 - Vehicle Measurement Blank. A form designed for measuring spacings, extent of movement and energy required for the operation of Army vehicles. The data from it were used in the rationale for developing evaluation devices and selection of predictors of hypothesized differential value in the early phases of the study. (Not shown.)

9. CRT 268 - Instructor's Evaluation Inventory. A form drawn up and used on 21 instructors to ascertain the basis of driver evaluation used by Army motor vehicle training personnel. It was used as a factor in the selection of tests made in the second run.

10. CRT 269 - Data Sheet. A mimeographed form used during the test period for entering data collected in standard form.

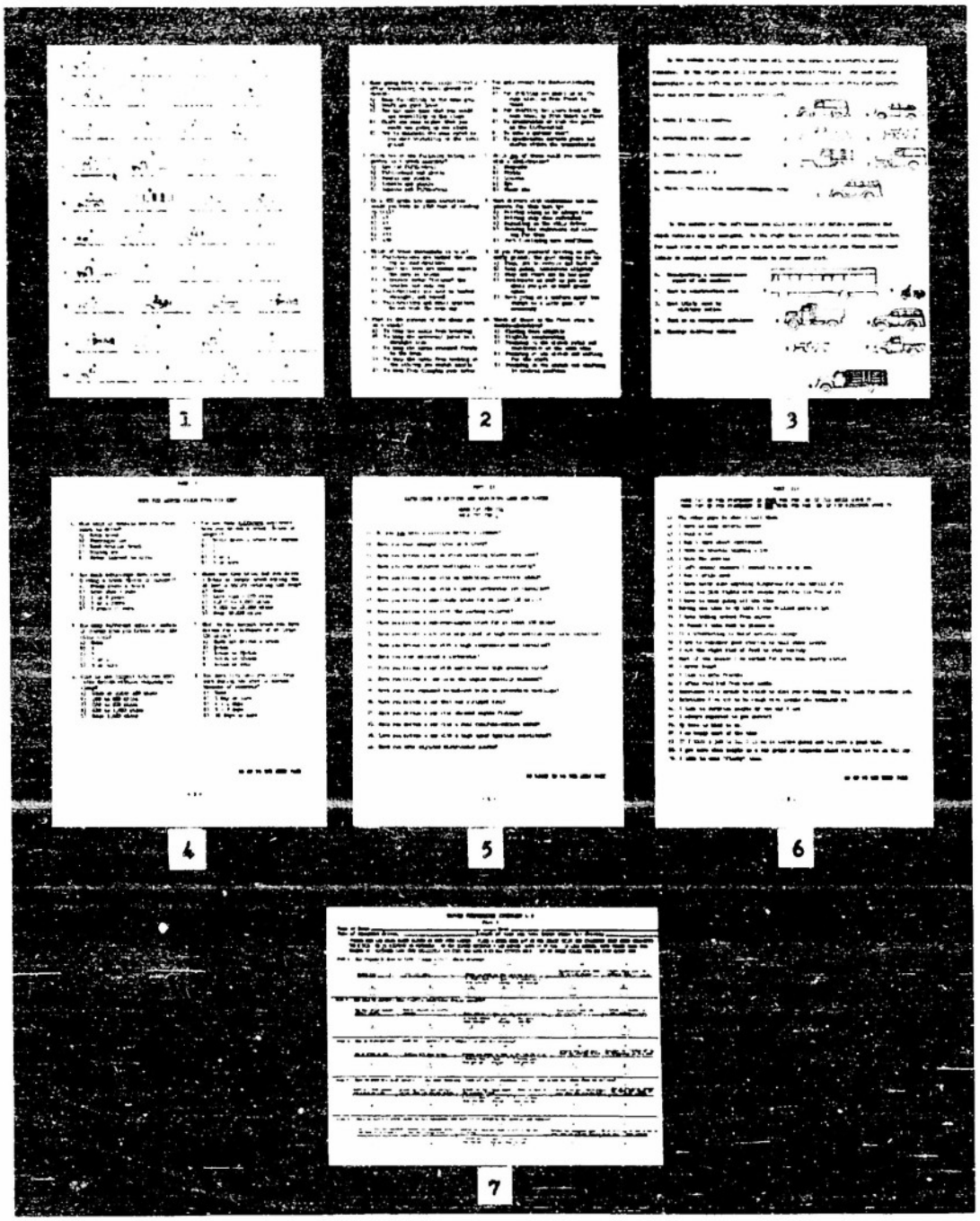
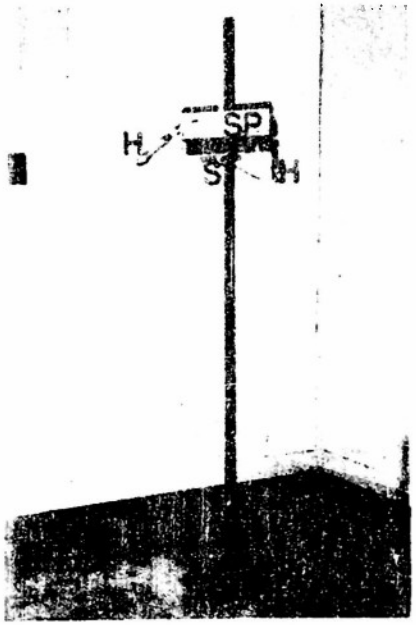
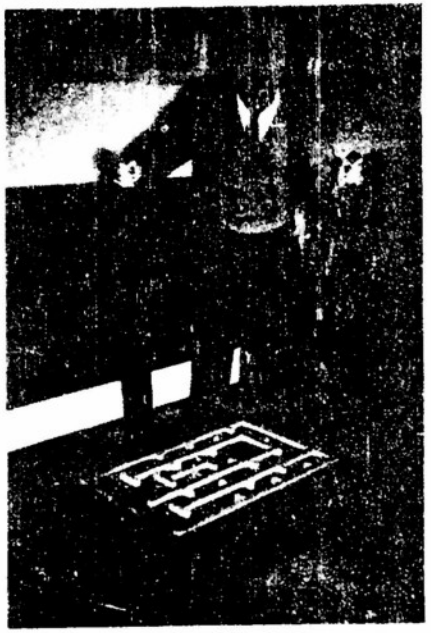


PLATE I

1. Torsion dynamometer for measuring hand and arm strength. The height of the grips (G) is approximately 30 inches. The subject stands over the apparatus and twists inward thus exerting pressure on the platform scale (P).



2. Tension dynamometer for measuring shoulder strength at arms length. The handles (H) held at suitable distance established by the subject's reach and the outward pull exerted is measured by a standard scale (SP). A spacer (S) keeps this distance relatively constant.



3. Coordinometer is used to measure gross coordination. In addition it involves a certain element of attention, space and movement perception, as well as judgment and emotional control for successful manipulation.

PLATE II

APPENDIX B - RELIABILITY OF TESTS USED

The reliability of most of the tests used was reported in the previous study (2). The split-half reliability coefficients of the new instruments used as predictors are given in Table B-1. Data from the preliminary trial were used.

TABLE B-1. Reliability of New Tests

Army Desig.	Predictor	N	r	Corrected r
CRT 260	Vehicle Knowledge (all subjects)	314	.56	.72
CRT 266	Motor Vehicle Preference (White subjects)	102	.94	.97
CRT 262	H-V Know-How (Negro)	212	.63	.78
	(White)	102	.76	.87
CRT 263	Coordinometer (5 trials)	278	.35	.52

During the interim between runs, these tests were further studied and improved, as well as adjustments made in length and directions for administration, such that the reliabilities were appreciably raised. CRT 266 was item analyzed and condensed from 96 to 65 items and CRT 263 was reworked and directions improved to produce higher reliability.

APPENDIX C - THE CRITERION

After considerable exploration, it was decided to use three criterion elements as follows:

1. Q - Ratings by instructors of the Army motor vehicle course in the TRTC School.

Associates' ratings were not usable since some men did not know how to drive and few trainees had an opportunity to learn to know others or to know about their driving from observation.

The scale section of the Army Driver Rating Scale, DA PRT 2408 was employed. Four ratings were obtained on each driver and a mean of all ratings made on scales 2, 3, 4 and 5 were reduced to standard scores as the rating index for this element of the criterion.

2. R - Class grades from the TRTC School.

Since the preliminary purpose of the School was to select and train drivers for heavy and light Army motor vehicle operation, it was hypothesized that instructors ought to have a fair idea of their trainees after close association with them for ten weeks. Part of their military duties was assigning grades with classification of drivers as the primary objective.

The mean of three grades was used as the score on this element of the criterion. In a few instances one grade was missing and the customary academic practice of using the mean of the two grades available was adopted.

3. S - Army Driver Road Test - DA PRT 561.

Since this test is used in examining and classifying Army drivers, this instrument was chosen as the third criterion element. The test has 200 items weighted differentially. Failing an item reduces the score from 200 by the number of points the item is weighted.

The split-half reliability coefficients (corrected by Spearman-Brown formula) of the criterion elements are shown in Table C-1.

Table C-1. Reliability Coefficients of Criterion Elements.

Criterion Element	N	r	Corrected r
Heavy Driver Ratings - FRT 2408 1st and 4th vs 2nd and 3rd	389	.42	.59
Light Driver Ratings - FRT 2408 1st and 4th vs 2nd and 3rd	380	.65	.79
Heavy Driver Grades 1st and 4th vs 2nd and 3rd	252	.55	.72
Light Driver Grades 1st and 4th vs 2nd and 3rd	306	.58	.73
Heavy Drivers Road Test	360	.50	.67
Light Drivers Road Test	339	.41	.58

From the results obtained the reliability of a composite of the three elements of the criterion as used should run well over .80 as a conservative estimate. This appeared to be satisfactory for the purpose of the present study. The composite criterion (called T) used was an equal weighting of the three criterion elements based upon standardized scores for each.

Intercorrelation of the three elements of the criterion and their composite is shown in Table C-2.

Table C-2. Intercorrelations of the Criterion Elements and Composite.

Heavy Driver Groups

	Group A					Group B		
	Q	R	S*	T		Q	R	T
T	.71	.80	.69	.80*	T	.72	.73	.80
S	.33	.38	.67		R	.20	.72	
R	.33	.72			Q	.59		
Q	.59							

Light Driver Groups

	Group C				Group D		
	Q	R	T		Q	R	T
T	.82	.72	.80	T	.81	.83	.80
R	.26	.72		R	.40	.72	
Q	.59			Q	.59		

*S was not put into the matrix for Groups B, C and D.

APPENDIX D - PROCEDURAL INFORMATION

The following information for accomplishing the collection of data was transmitted to key personnel at Ft. Eustis.

IMPORTANT INFORMATION

1. A Department of Army contract, No. DA-49-083 OSA-517, "Differential Characteristics of Army Drivers of Light and Heavy Motorized Equipment," negotiated with Iowa State College is being continued at Ft. Eustis by request of the Army beginning about March 30 and continuing until the records of at least 250-300 white or colored trainees are completed. Dr. A.R. Lauer is in charge of the project and will have two civilian assistants, Mr. Harold I. Stalder and Mr. Lewis A. Vavra, on the Post during this testing period. M/Sgt. R.W. Hopper will assist in collecting the criterion data in the form of road tests, examination grades and ratings used by the Army in evaluating driving performance. He has been assigned to otherwise assist this project as liaison NCO.

2. These men will <u>not</u> need be quartered on the Post but the necessary credentials for convenience of such operations of civilians on the Post will be appreciated.

3. The following provisions will greatly aid in reducing the time necessary to secure sufficient subjects for cross-validation of tests selected from the data obtained on the first run:

a. Reduction to the minimum in absenteeism for all training and testing periods of classes used as subjects in this project.

b. Punctuality of groups reporting for testing. Such examinees will be needed for the period of one normal-duty day in groups of from 25-30 as outlined below.

c. The groups of men should be accompanied by one officer and one NCO if at all possible when reporting.

d. Since the grades given by the TC School seem to be the best all-around criterion against which to validate tests, it is suggested that at least three or four examinations of not less than 50 items each be given during the course. (This is approximately the same as used at present.) It is requested that true-false and other two-answer questions be kept to the minimum in order to increase the reliability of grades given during this period.

e. Especial care should be taken in scoring the Army Road test and three ratings to be given during the course on the third, fifth and seventh weeks respectively.

f. Special briefing should be given examiners and instructors on the Army SOP used for the regular examinations and Army Road tests. This applies particularly to new assignees.

g. Test papers and Road Test forms should be retained for use in the analysis by our staff. M/Sgt. Hopper will collect them for this purpose.

4. Personnel and physical facilities needed.

a. Testing personnel. If possible two qualified enlisted men would expedite the work during the days devoted to testing.

b. Personnel to be used as subjects. It seems at present each class in the TC School is divided into those taking the light vehicle driving course and those taking the heavy vehicle driving course. One day for administering these tests during the second week of training seems to fit best into the program. Assuming there are 100 men in each class, we suggest the following division into test groups. It is likely the tests will start on Monday, March 30th.

1) Monday 0800-1700 - one half of the light vehicle class in their second week - 25 men.

2) Tuesday 0800-1700 - one half of heavy vehicle class in their second week - 25 week.

3) Wednesday 0800-1700 - second half of same heavy vehicle class - 25 men.

4) Thursday 0800-1700 - second half of same light vehicle class - 25 men.

In case there are less than 100 in the total class, it is requested that about one-fourth be sent each day. Friday and Saturday morning will be used to grade the tests. No subjects will be needed.

c. Physical facilities needed.

1) A testing room to comfortably seat 25-30 men with field tables or others having a space at least 2½ x 2½ feet for each man. Some of the FRT tests require this amount of space. This room should be centrally located with usual temperature controls. The lighting should be adequate for reading purposes. About 50 per cent more room will be needed than that required for seating to allow isles for the monitors to circulate.

2) About 10 tables will be needed for instruments, apparatus and other tests used. There should be about 50 field tables or their equivalent in all available. About the same number of substantial chairs are needed. Folding chairs are satisfactory.

3) There should be one or two portable blackboards unless there are blackboards on the walls.

4) The testing room should have latrine facilities close. It should be away from any unusual noise or other type of distractions.

5) An office for the research staff's use attached to the testing room is needed. An orderly room with file is satisfactory. This should be provided with locking facilities for security of tests and equipment to satisfy Army requirements.

6) The room and testing quarters should be provided with customary janitor service as given other similar barracks or quarters on the Post.

5. Parking space for one or two cars at least should be provided at or very near the testing station, since emergency trips are often necessary.

6. The exact date of scheduling the first class will be in the hands of Lt. Wienke, Coordinator of the Project, in sufficient time for making the arrangements. It is tentatively set for Monday, March 30, 1953.

Submitted March 10, 1953

(Signed) A.R. Lauer

A.R. Lauer
Project Director

This schedule was carried out with only minor changes during the study.

APPENDIX E - BASIC DATA USED IN PREPARATION OF SELECTED BATTERIES

The matrix used in each case is shown for both experimental and cross-validation groups.

Betas were calculated for both experimental and cross-validation groups. The results are shown in Table E-1 to E-12 inclusive.

Means and standard deviations for all tests used in the experimental groups (A and C) are given. Those for variables which gave promise of holding up in cross-validation are also given for Groups B and D. Table E-13 presents these data.

Table E-1. Suggested Final Selection Battery for Heavy Drivers

Group A (Experimental)

	Variable	Army Desig.	3	X	H	M	F	T
3	H-V Know-How	CRT 262	---					
X	Auto. Information	ACT	.64	---				
H	Two-Hand Coordination	HRT 2387	.14	.13	---			
M	S.D. Blank, Total	CRT 257	.46	.41	.09	---		
F	Vis. Acuity (II,III&IV)	CRT 202	.41	.41	.24	.36	---	
T	Composite		.47	.43	.17	.30	.31	---

R = .52

Cross-Validation Data

	Variable	Validities from Group B	Betas from Group A
3	H-V Know-How	.3665	.2835
X	Auto. Information	.3691	.1815
F	Vis. Acuity (II, III & IV)	.3707	.0776
H	Two-Hand Coordination	.2263	.0784
M	S.D. Blank, Total	.2635	.0564

Cross-Validity r = .45
Basic data for Battery I

Table E-2. Suggested Final Selection Battery for Heavy Drivers

Group B (Cross-Validation)

	Variable	Army Desig.		X	H	M	F	T
3	H-V Know-How	CRT 262	---					
X	Auto. Information	ACT	.66	---				
H	Two-Hand Coordination	FRT 2387	.16	.14	---			
M	S.D. Blank, Total	CRT 257	.47	.44	.03	---		
F	Vis. Acuity (II,III&IV)	CRT 202	.45	.45	.27	.31	---	
T	Composite		.37	.37	.23	.26	.37	---

R = .47

Back Cross-Validation Data

	Variable	Validities from Group A	Betas from Group B
X	Auto. Information	.4273	.1522
F	Vis. Acuity (II,III & IV)	.3063	.1871
3	H-V Know-How	.4678	.1225
M	S.D. Blank, Total	.2970	.0778
H	Two-Hand Coordination	.1656	.1338

Back Cross-Validity r = .48
Basic data for Battery I

Table E-3. Final Alternate Battery for Heavy Drivers

Group A (Experimental)

	Variable	Army Desig.	3	C	N	O	T
3	H-V Know-How	CRT 262	---				
C	Lateral Perception	CRT 200	.46	---			
N	Difference Detection	CRT 216	.50	.59	---		
O	Coordinometer	CRT 263	.18	.12	.13	---	
T	Composite		.47	.34	.32	.11	---

R = .49

Cross-Validated Data

	Variable	Validities from Group B	Betas from Group A
3	H-V Know-How	.3665	.3780
C	Lateral Perception	.3076	.1445
N	Difference Detection	.3311	.0397
O	Coordinometer	.1924	.0211

Cross-Validity r = .41
Basic data for Battery II

Table E-4. Final Alternate Battery for Heavy Drivers.

Group B (Cross-Validation)

	Variable	Army Desig.	3	C	N	O	T
3	H-V Know-How	CRT 262	---				
C	Lateral Perception	CRT 200	.43	---			
N	Difference Detection	CRT 216	.52	.56	---		
O	Coordinometer	CRT 263	.24	.24	.23	---	
T	Composite		.37	.31	.33	.19	---

R = .42

Back Cross-Validation Data

	Variable	Validities from Group A	Betas from Group B
3	H-V Know-How	.4678	.2291
C	Lateral Perception	.3436	.1193
N	Difference Detection	.3168	.1267
O	Coordinometer	.1105	.0808

Back Cross-Validity r = .48
Basic data for Battery II

Table E-5. Final Battery for Light Vehicle Drivers

Group C (Experimental)

	Variable	Army Desig.	5	9	E	I	O	T
5	Driver Know-How	PRT 2412	---					
9	Emergency Judgment	CRT 87	.69	---				
E	Strength - Hand	CRT 263	.00	-.16	---			
I	S.D. Blank, Part I	CRT 257	.19	.07	.23	---		
O	Coordinometer	CRT 263	.11	-.03	.21	.27	---	
T	Composite		.25	.17	.19	.37	.29	---

R = .47

Cross-Validation Data

	Variable	Validities from Group D	Betas from Group C
5	Driver Know-How	.4099	.1181
I	S.D. Blank, Part I	.1342	.2643
O	Coordinometer	.1509	.1896
9	Emergency Judgment	.2875	.0897
E	Strength - Hand	.2107	.1042

Cross-Validity r = .35
Basic data for Battery III

Table E-6. Final Battery Selected for Light Vehicle Drivers

Group D (Cross-Validation)

	Variable	Army Desig.	5	9	E	I	O	T
5	Driver Know-How	MRT 2412	---					
9	Emergency Judgment	CRT 87	.49	---				
E	Strength - Hand	CRT 263	.23	.06	---			
I	S.D. Blank, Part I	CRT 257	.23	.10	.19	---		
O	Coordinometer	CRT 263	.10	.07	.16	.08	---	
T	Composite		.41	.29	.21	.13	.15	---

R = .45

Back Cross-Validation Data

	Variable	Validities from Group C	Betas from Group D
5	Driver Know-How	.2496	.3123
O	Coordinometer	.2933	.0912
E	Strength - Hand	.1901	.1134
9	Emergency Judgment	.2680	.1181
I	S.D. Blank, Part I	.3677	.0204

Back Cross-Validity r = .35
Basic data for Battery III

Table E-7. Alternate Battery for Light Vehicle Drivers Using all Paper-and-Pencil Tests.

Group C (Experimental)

	Variable	Army Desig.	5	9	I	N	W	T
5	Driver Know-How	MRT 2412	---					
9	Emergency Judgment	CRT 87	.69	---				
I	S.D. Blank, Part I	CRT 257	.19	.07	---			
N	Difference Detection	CRT 216	.56	.60	.03	---		
W	Shop Mechanics	ACT	.60	.67	.07	.60	---	
T	Composite		.25	.17	.37	.11	.16	---

R = .41

Cross-Validation Data

	Variable	Validities from Group D	Betas from Group C
5	Driver Know-How	.4099	.1648
I	S.D. Blank, Part I	.1342	.3333
W	Shop Mechanics	.3018	.0375
9	Emergency Judgment	.2875	.0303
N	Difference Detection	.2852	-.0375

Cross-Validity r = .29
Basic data for Battery IV

Table E-8. Alternate Battery Using all Paper-and-Pencil Tests

Group D (Cross-Validation)

	Variable	Army Desig.	5	9	I	N	W	T
5	Driver Know-How	FRT 2412	---					
9	Emergency Judgment	CRT 87	.49	---				
I	S.D. Blank, Part I	CRT 257	.23	.10	---			
N	Difference Detection	CRT 216	.44	.62	.08	---		
W	Shop Mechanics	ACT	.50	.66	.07	.59	---	
T	Composite		.41	.29	.13	.29	.30	---

R = .43

Back Cross-Validation Data

	Variable	Validities from Group C	Betas from Group D
5	Driver Know-How	.2496	.3104
I	S.D. Blank, Part I	.3677	.0464
W	Shop Mechanics	.1585	.0738
N	Difference Detection	.1079	.0806
9	Emergency Judgment	.1680	.0317

Back Cross-Validity r = .27
Basic data for Battery IV

Table E-9. Light Battery Used on Heavy Drivers

Group A (Experimental)

	Variable	Army Desig.	5	9	E	I	O	T
5	Driver Know-How	FRT 2412	---					
9	Emergency Judgment	CRT 87	.63	---				
E	Strength - Hand	CRT 263	.12	.07	---			
I	S.D. Blank, Part I	CRT 257	.19	.13	.09	---		
O	Coordinometer	CRT 263	.13	.13	.19	.11	---	
T	Composite		.40	.33	.11	.11	.11	

R = .44

Table E-10. Light Battery Used on Heavy Drivers.

Group B (Cross-Validation)

	Variable	Army Desig.	5	9	0	T
5	Driver Know-How	PRT 2412	---			
9	Emergency Judgment	CRT 87	.62	---		
C	Coordinometer	CRT 265	.31	.19	---	
T	Composite		.38	.33	.19	---

R = .41

Basic data on use of two light batteries when used on heavy drivers. Not cross-validated since intercorrelations for E and I were not calculated for Group B as they did not show promise and were dropped.

Table E-11. Heavy Batter I Applied to Light Group C (Experimental)

	Variable	Army Desig.	3	X	H	M	F	T
3	H-V Know-How	CRT 262	---					
X	Automotive Information	ACT	.59	---				
H	Two-Hand Coordination	PRT 2387	.09	.05	---			
M	S.D. Blank, Total	CRT 257	.50	.43	.09	---		
F	Vis. Acuity (II,III&IV)	CRT 202	.39	.42	.32	.34	---	
T	Composite		.22	.26	.18	.18	.19	---

R = .32

Cross-Validation Data

	Variable	Validities from Group D	Betas from Group C
X	Automotive Information	.2501	.1853
3	H-V Know-How	.4213	.0645
M	S.D. Blank, Total	.4052	.0444
H	Two-Hand Coordination	.0947	.1561
F	Visual Acuity (II, III & IV)	.2299	.0216

Cross-Validity r = .34

Basic data on application of heavy driver battery to light driver group.

Table E-12. Heavy Battery I Applied to Light Group D (Cross-Validation)

	Variable	Army Desig.	3	X	H	M	F	T
3	H-V Know-How	CRT 262	---					
X	Automotive Information	ACT	.61	---				
H	Two-Hand Coordination	PRT 2387	.13	.10	---			
M	S.D. Blank, Total	CRT 257	.48	.44	.11	---		
F	Visual Acuity (II,III&IV)	CRT 202	.42	.43	.25	.35	---	
T	Composite		.42	.25	.09	.41	.23	---

$\bar{R} = .49$

Back Cross-Validation Data

	Variable	Validities from Group C	Betas from Group D
3	H-V Know-How	.2188	.3254
M	S.D. Blank, Total	.1780	.2718
F	Vis. Acuity (II, III & IV)	.1895	.0295
H	Two-Hand Coordination	.1825	.0216
X	Automotive Information	.2594	-.0829

Back Cross-Validity $r = .22$

Basic data on application of heavy driver battery to light driver group.

Table E-13. Means and Standard Deviations of Variables Used in Final Run

	Group A N = 198		Group B N = 192		Group C N = 196		Group D N = 194	
	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
1	19.68	4.63	-----	----	18.15	4.80	-----	----
2	20.82	1.44	-----	----	20.68	1.58	-----	----
3	28.27	8.82	26.97	9.08	23.83	8.86	25.60	7.46
4	69.56	3.09	-----	----	69.36	6.08	-----	----
5	28.21	6.52	27.07	7.27	24.39	6.94	25.57	6.20
6	64.98	18.06	-----	----	59.95	18.47	-----	----
7	22.27	6.94	-----	----	22.35	7.01	22.79	7.02
8	72.77	3.54	-----	----	72.07	3.93	-----	----
9	16.54	5.00	15.69	5.53	15.12	5.07	15.84	5.28
A	36.93	2.44	37.27	2.52	36.33	2.07	-----	----
B	12.68	4.62	12.27	4.91	12.28	5.66	13.25	5.13
C	28.60	7.80	28.62	8.36	28.42	9.56	28.85	8.96
D	37.89	8.85	37.18	8.42	38.54	8.16	38.38	7.86
E	45.48	6.63	-----	----	43.43	6.90	43.91	6.98
F	43.33	10.44	41.84	11.80	40.18	11.73	40.75	12.06
G	31.29	8.62	-----	----	29.82	8.21	-----	----
H	112.52	27.83	111.09	25.13	109.29	22.61	111.95	23.99
I	9.62	3.36	-----	----	6.35	3.25	6.37	3.35
J	20.46	4.80	-----	----	18.95	4.68	-----	----
K	12.53	3.07	12.26	3.05	12.18	2.65	-----	----
L	55.45	7.40	54.94	8.48	53.59	8.95	-----	----
M	77.53	9.82	77.09	10.96	72.07	10.37	74.08	10.40
N	12.52	3.97	12.26	4.47	12.32	4.32	12.83	4.06
O	27.48	14.92	28.08	16.56	23.04	12.89	25.82	15.19
P	9.10	2.34	-----	----	9.07	2.50	-----	----
Q	96.57	19.98	102.09	22.33	101.13	21.70	98.93	18.31
R	100.47	21.40	97.99	21.31	99.79	19.53	100.53	19.83
S	98.95	17.19	-----	-----	99.53	9.15	-----	----
T	29.58	4.32	30.26	4.03	30.04	3.68	30.05	3.67
U	79.95	17.10	-----	----	79.84	19.36	-----	----
V	88.22	15.45	87.14	17.69	84.79	18.23	88.01	16.64
W	86.48	17.07	84.06	18.16	83.09	20.46	85.22	17.44
X	92.52	17.99	90.12	18.15	84.69	19.18	87.41	16.97